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(71)Applicant : SONY CORP

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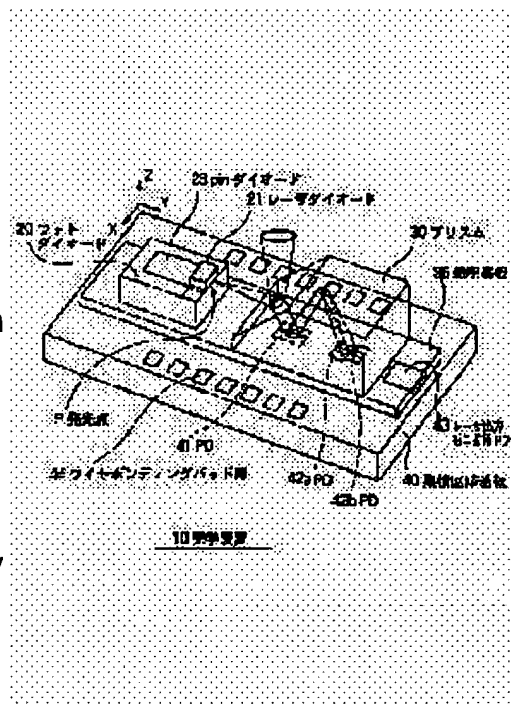
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(54) OPTICAL DEVICE AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical device capable of precisely connecting a transmission beam to a light receiving area of a light receiving element and inexpensively and easily manufacturing it, and its manufacturing method.

SOLUTION: The optical device 10 is constituted by providing a first pedestal 35 having light transmissivity in, at least, a part of it, at least a light emitting element 21 placed on the first pedestal 35, a light branching means 30, placed on the first pedestal 35 at a prescribed interval with the light emitting element 21, branching at least a part of the emission beam of the light emitting element 21, irradiating it to a body to be irradiated and waveguiding a reflection beam from the body to be irradiated so as to transmit through the first pedestal 35 and a second pedestal 40 having the light receiving elements 41, 42, and to which the first pedestal 35 so that the transmission beam of the first pedestal 35 is attached, is connected to within the light receiving areas of the light receiving elements 41, 42.



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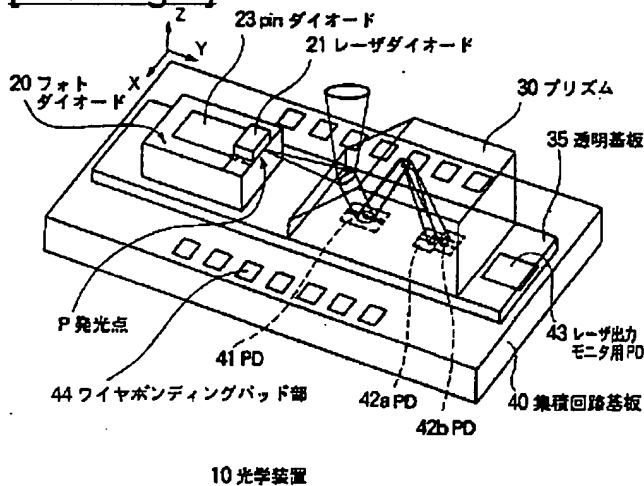
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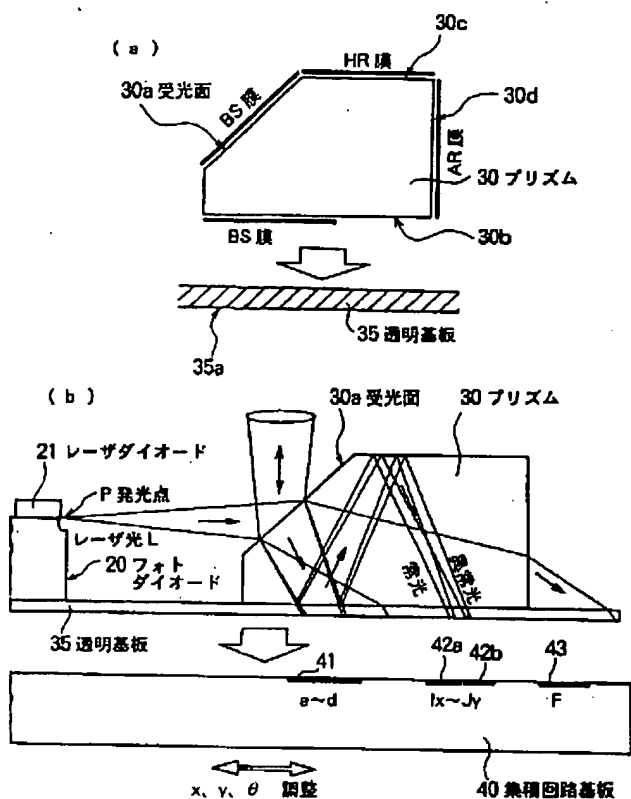
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DRAWINGS

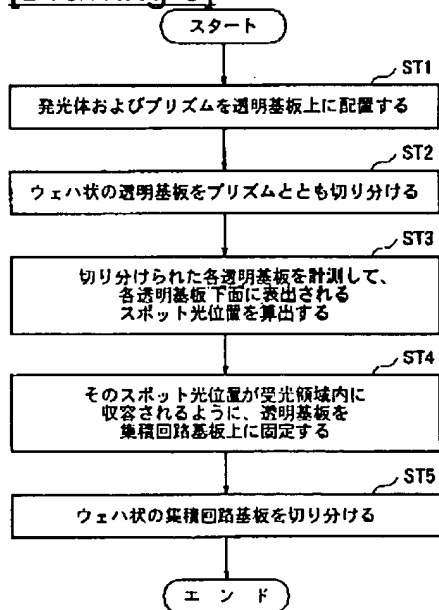
[Drawing 1]



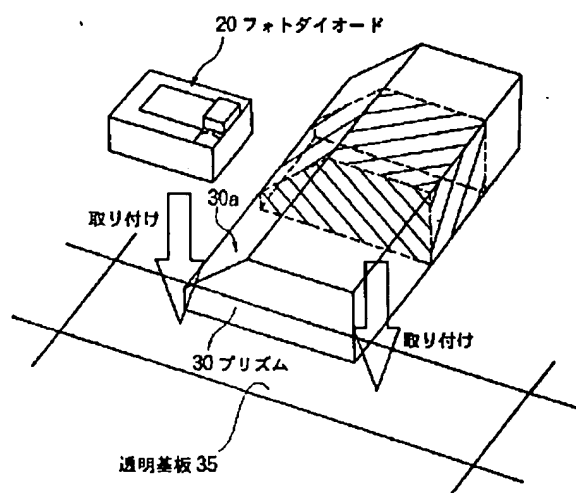
[Drawing 2]



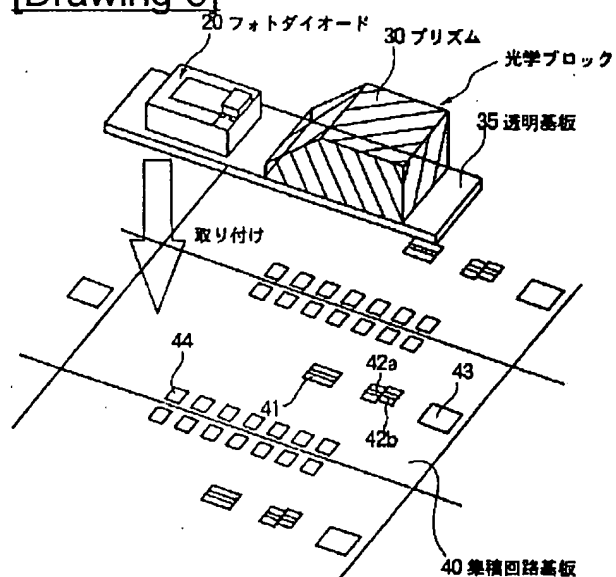
[Drawing 3]



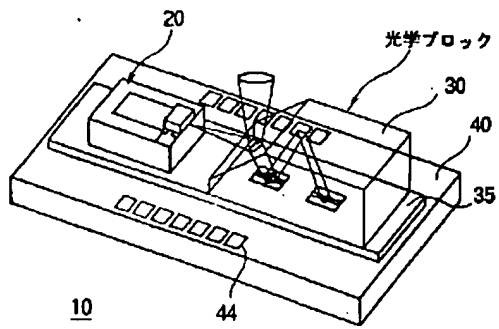
[Drawing 4]



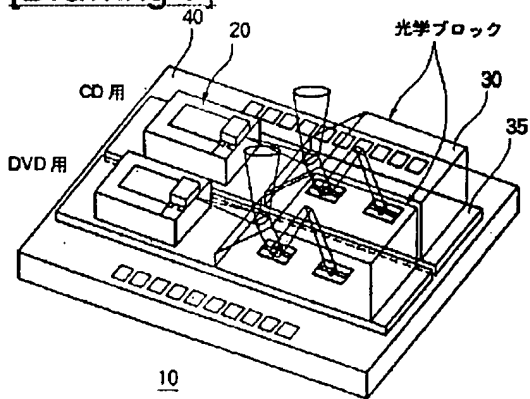
[Drawing 5]



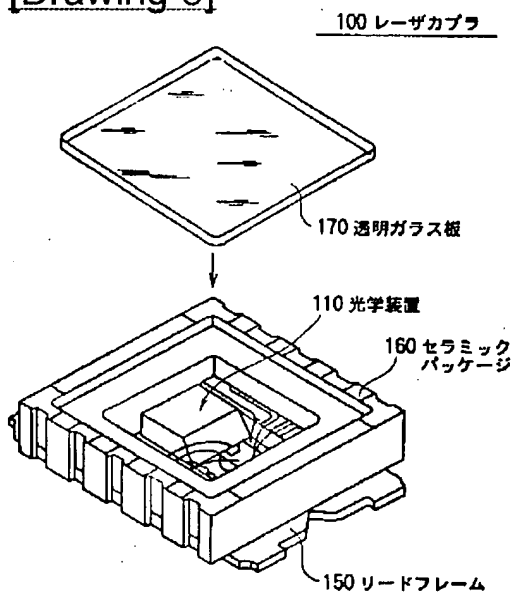
[Drawing 6]



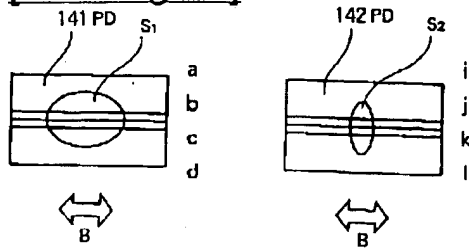
[Drawing 7]



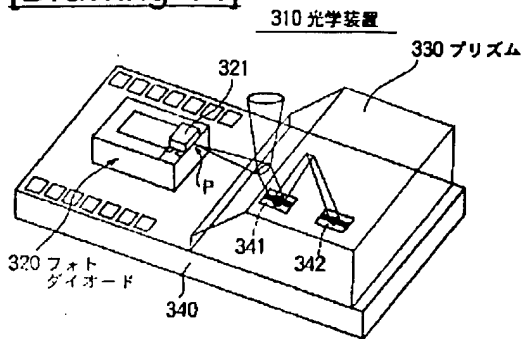
[Drawing 8]



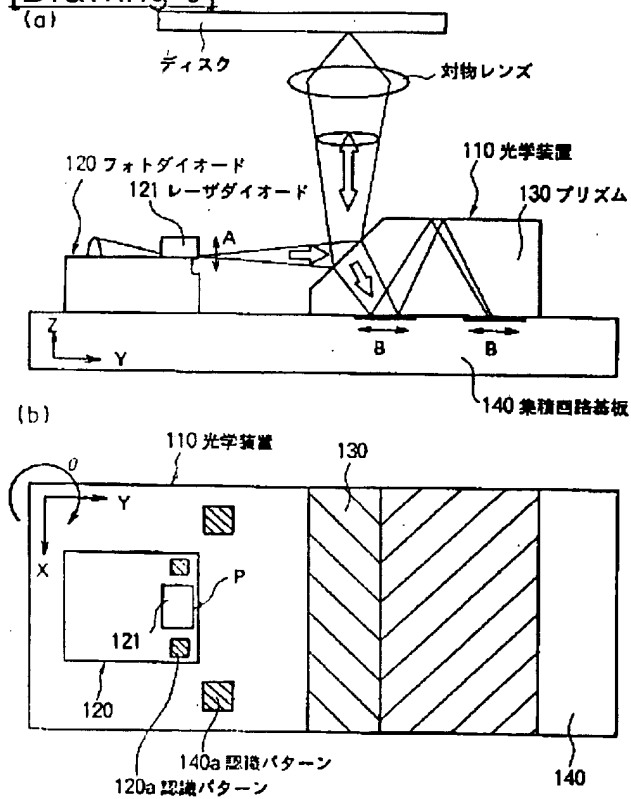
[Drawing 11]



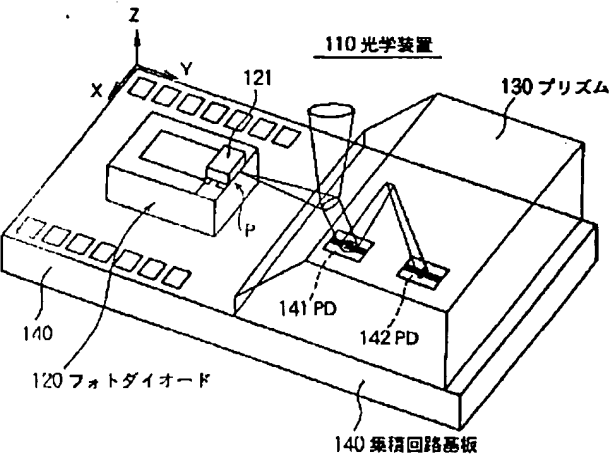
[Drawing 14]



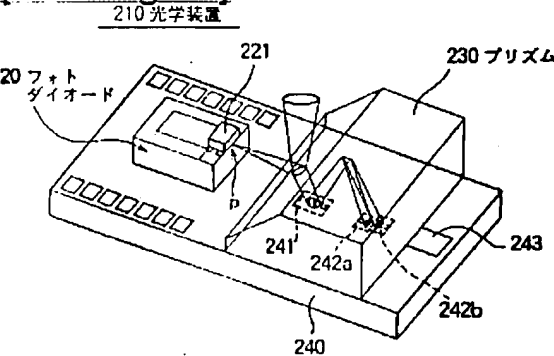
[Drawing 9]



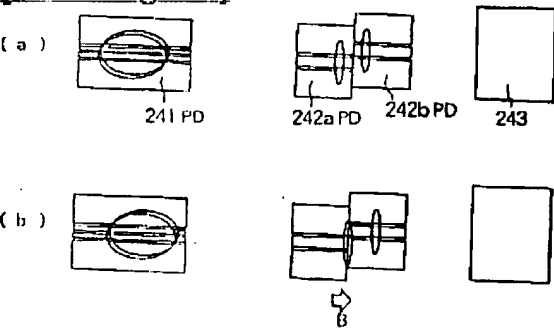
[Drawing 10]



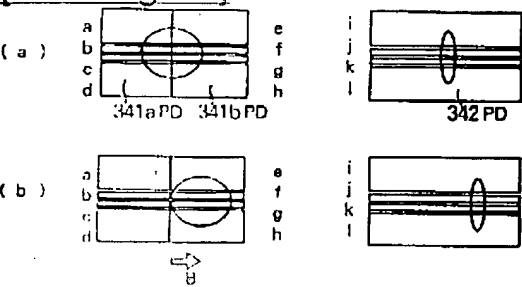
[Drawing 12]



[Drawing 13]



[Drawing 15]



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CLAIMS

[Claim(s)]

[Claim 1] At least one light emitting device by which at least the part was laid on the 1st pedestal which has light transmission nature, and said 1st pedestal, On said 1st pedestal, set said light emitting device and predetermined spacing, and it is laid, branch a part of outgoing radiation light [at least] of the light emitting device concerned, and an irradiated object is irradiated. Optical equipment which has an optical branching means to guide the reflected light from the irradiated object concerned so that said 1st pedestal may be penetrated, and the 2nd pedestal in which the 1st pedestal concerned was attached so that it might have a photo detector and the transmitted light of said 1st pedestal might be combined in the light-receiving field of the photo detector concerned.

[Claim 2] Said optical branching means is optical equipment according to claim 1 with which it is a spectroscope and the optical branching side which the outgoing radiation light of said light emitting device is branched, and guides the reflected light from said irradiated object is formed in said spectroscope.

[Claim 3] Said spectroscope is a birefringence spectroscope. Among the contact side of said birefringence spectroscope and 1st pedestal, or the contact side of said 1st pedestal and 2nd pedestal in one of contact sides A part of reflected light from said irradiated object currently guided inside said birefringence spectroscope is penetrated, and the branching film made to reflect the remainder is prepared. To said 2nd pedestal Optical equipment according to claim 2 with which at least two photo detectors which detect Tsunemitsu separated by said birefringence spectroscope and abnormality light are prepared.

[Claim 4] Optical equipment according to claim 2 with which the continuation side with the opposed face of the couple formed in said 1st pedestal is formed in said spectroscope.

[Claim 5] Optical equipment according to claim 1 with which two or more photo detectors which each transmitted light which two or more optical branching means established corresponding to two or more light emitting device and each light emitting device are laid, respectively, and penetrated said 1st pedestal at said 2nd pedestal combines at said 1st pedestal are prepared.

[Claim 6] Said 1st pedestal is optical equipment according to claim 1 which consists of a highly thermally-conductive material.

[Claim 7] Said 2nd pedestal is optical equipment according to claim 1 which has two or more photo detectors, and is attached so that each transmitted light to which two or more 1st pedestals in which two or more optical branching means established corresponding to two or more light emitting device and each light emitting device were laid, respectively penetrated said each 1st pedestal may be combined with each of two or more of said photo detectors by said 2nd pedestal.

[Claim 8] Optical equipment according to claim 7 with which the light emitting device from which luminescence wavelength differs, respectively is laid in said two or more 1st pedestals.

[Claim 9] Optical equipment according to claim 7 with which the light emitting device from which output reinforcement differs, respectively is laid in said two or more 1st pedestals.

[Claim 10] Optical equipment according to claim 7 with which an optical branching means by which waveguide properties differ, respectively is laid in said two or more 1st pedestals.

[Claim 11] The 1st pedestal in which it is optical equipment which reads the information which detected the amount of reflected lights of the light which irradiated the optical disk, and was recorded on said disk, and at least a part has light transmission nature, On at least one light emitting device laid on said 1st pedestal, and said 1st pedestal An optical branching means to set said light emitting device and predetermined spacing, to be laid, to branch a part of outgoing radiation light [at least] of the light emitting device concerned, and to irradiate said optical disk, and to guide the reflected light from the optical disk concerned so that said 1st pedestal may be penetrated, Optical equipment which has a photo detector, and has the 2nd pedestal in which the 1st pedestal concerned was attached so that the transmitted light of said 1st pedestal may be combined in the light-receiving field of the photo detector concerned.

[Claim 12] Said optical branching means is optical equipment according to claim 10 with which it is a spectroscope and the optical branching side which the outgoing radiation light of said light emitting device is branched, and guides the reflected light from said optical disk is formed in said spectroscope.

[Claim 13] Said spectroscope is a birefringence spectroscope. Among the contact side of said birefringence spectroscope and 1st pedestal, or the contact side of said 1st pedestal and 2nd pedestal in one of contact sides A part of reflected light from said optical disk currently guided inside said birefringence spectroscope is penetrated, and the branching film made to reflect the remainder is prepared. To said 2nd pedestal Optical equipment according to claim 12 with which at least two photo detectors which detect Tsunemitsu separated by said birefringence spectroscope and abnormality light are prepared.

[Claim 14] Optical equipment according to claim 12 with which the continuation side with the opposed face of the couple formed in said 1st pedestal is formed in said spectroscope.

[Claim 15] Optical equipment according to claim 10 with which two or more photo detectors which each transmitted light which two or more optical branching means established corresponding to two or more light emitting device and each light emitting device are laid, respectively, and penetrated said 1st pedestal at said 2nd pedestal combines at said 1st pedestal are prepared.

[Claim 16] Said 1st pedestal is optical equipment according to claim 10 which consists of a highly thermally-conductive material.

[Claim 17] Said 2nd pedestal is optical equipment according to claim 10 which has two or more photo detectors, and is attached so that each transmitted light to which two or more 1st pedestals in which two or more optical branching means established corresponding to two or more light emitting device and each light emitting device were laid, respectively penetrated said each 1st pedestal may be combined with each of two or more of said photo detectors by said 2nd pedestal.

[Claim 18] Optical equipment according to claim 17 with which the light emitting device from which luminescence wavelength differs, respectively is laid in said two or more 1st pedestals.

[Claim 19] Optical equipment according to claim 17 with which the light emitting device from which output reinforcement differs, respectively is laid in said two or more 1st pedestals.

[Claim 20] Optical equipment according to claim 17 with which an optical branching means by which waveguide properties differ, respectively is laid in said two or more 1st pedestals.

[Claim 21] Branch a part of outgoing radiation light [at least] of the light emitting device of at least 1, and said light emitting device, and an irradiated object is irradiated. The process which lays an optical branching means to guide the reflected light from the irradiated object concerned so that the 1st pedestal may be penetrated, on the 1st [said] pedestal in which at least a part has light

transmission nature, The arrangement condition of the light emitting device laid on said 1st pedestal and an optical branching means is measured. So that it may be combined in the process which computes the transparency location of the transmitted light concerned in said 1st pedestal, and the light-receiving field of a photo detector where the transparency location of said transmitted light was established in the 2nd pedestal based on said calculation result The manufacture approach of optical equipment of having the process which attaches said 1st pedestal on said 2nd pedestal.

[Claim 22] The manufacture approach of optical equipment according to claim 21 of having the process which considers said each 1st pedestal as an optical block, and carves it into a wafer for every block after laying said light emitting device and an optical branching means on the 1st [said] pedestal by which two or more formation was carried out, respectively.

[Claim 23] Said optical branching means is the manufacture approach of the optical equipment according to claim 22 which can be carved simultaneous when it is laid over two or more optical blocks and said each optical block is carved.

[Claim 24] The manufacture approach of optical equipment according to claim 22 of having the process which carves said 2nd pedestal for every pedestal after laying said optical block, respectively on the 2nd [said] pedestal by which two or more formation was carried out at the wafer.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the optical equipment used for pickups, such as a CD player, and its manufacture approach.

[0002]

[Description of the Prior Art] In CD (Compact Disc) player or LD (Laser Disc) player, in order to read the information on a disk, the pickup is used, and the laser coupler as shown in drawing 8 is used for the pickup. A laser coupler integrates a laser diode, prism, a photodetector, etc. to one, and a thin shape and since it is lightweight, and reliable and comparatively cheap, it is used for many optical instruments.

[0003] Below, a laser coupler and conventional optical equipment are explained based on a drawing. The perspective view of the optical equipment which shows the plan of the optical equipment which shows the perspective view in which drawing 8 shows a laser coupler, and drawing 9 (a) in the side elevation of conventional optical equipment, and shows drawing 9 (b) to drawing 9 (a), and drawing 10 to drawing 9, and drawing 11 are drawings for explaining the photo detector currently used for the optical equipment shown in drawing 9.

[0004] Generally, as shown in drawing 8, the laser coupler 100 lays optical equipment 110 on a leadframe 150, and has a bonnet and the composition of having put further the transparency glass plate 170 which makes light penetrating on the top face, with the frame type ceramic package 160 in the perimeter.

[0005] A laser beam is made to emit light from the laser diode 121 as a light emitting device, as shown in optical equipment 110 at drawing 9 and drawing 10. Moreover, the photodiode 120 which detects the output reinforcement of a laser

beam in response to the laser beam (or "LOP (Laser-diode OnPhoto-detector)"), The prism 130 which makes the laser beam which emitted light from the laser diode 121 refracted is arranged on the top face of the integrated-circuit substrate (or "PD-IC (Photo Detector-IC)") 140 which controls a photodiode 120.

[0006] Recognition pattern 140a and recognition pattern 120a which are used when positioning a photodiode 120 on the integrated-circuit substrate 140, as shown in drawing 9 (b) are given to the top face of the integrated-circuit substrate 140 and a photodiode 120, respectively.

[0007] the amount of gaps of the direction [as opposed to / the recognition patterns 140a and 120a are picturized using the CCD camera which is not illustrated from the right above / optical equipment 110 / direction, i.e., a Z direction, and / the integrated-circuit substrate 140 of a photodiode 120 by the picturized image] of X, and the direction of Y -- and it falls over and an include angle theta is called for. Based on those values, a photodiode 120 is tuned finely and positioned in the location of normal.

[0008] If it is positioned by high degree of accuracy on the integrated-circuit substrate 140 with the recognition patterns 140a and 120a which the photodiode 120 mentioned above, as shown in drawing 11 , in the light-receiving field of two PDs (Photo Detector)141,142 established in the integrated-circuit substrate 140, the laser beam from a laser diode 121 will turn into spot light of an ellipse form, and will project on those abbreviation cores.

[0009]

[Problem(s) to be Solved by the Invention] However, even if it has positioned the photodiode 120 to high degree of accuracy how on the integrated-circuit substrate 140, it is difficult to obtain spot light which has been projected on the light-receiving field of PD141,142 shown in drawing 11 only by raising X of a photodiode 120, and the location precision of only the direction of Y.

[0010] That is, the about dozens of micrometers point P emitting [laser] light will vary [about the Z direction of the system of coordinates set as drawing 9 (a) and drawing 10] in the Z direction shown in drawing 9 (a) by the arrow head A, for example by dispersion by the thickness of adhesives, such as a silver paste, applied to the contact side of dispersion by the dimension error of the thickness of photodiode 120 the very thing, or the photodiode 120 and the integrated-circuit substrate 140. The result from which spot light shifts in the direction of Y shown in drawing 9 (a) and drawing 11 by the arrow head B by that cause will be caused. Moreover, a gap in the direction of arrow-head B mentioned above may occur by dispersion in the Z direction of the arrangement location of prism 130 similarly.

[0011] Although it is also possible to obtain a good spot light as shown in drawing 11 by making the mounting location of prism 130 offset in the direction of Y after positioning a photodiode 120 on the integrated-circuit substrate 140, by the approach of moving prism 130, generating of defocusing is induced in many cases and the inconvenience of causing poor reading of an optical disk arises.

[0012] drawing for the perspective view in which drawing 12 shows the mold optical equipment corresponding to an optical MAG signal, drawing 13 (a), and (b) to explain the photo detector currently used for the optical equipment shown in drawing 12, and drawing 14 -- DPD (Differential Phase Detection) -- law -- the perspective view showing response mold optical equipment, drawing 15 (a), and (b) are drawings for explaining the photo detector currently used for the optical equipment shown in drawing 14.

[0013] To the mold optical equipment 210 corresponding to the optical MAG signal shown in drawing 12 The birefringence prism 230 which makes incident light divide into two light by the difference in polarization is used. To the integrated-circuit substrate 240 PD241 which detects the laser reflected light from the disk which is not illustrated through the birefringence prism 230, PD242b which detects only PD242a and abnormality light which detect only Tsunemitsu among the reflected lights from PD241, and PD243 which carries out the monitor of the output from the front of laser are formed.

[0014] Although spot light as shown in drawing 13 (a) will be obtained if a photodiode 220 and the birefringence prism 230 are arranged on the integrated-circuit substrate 240 at high degree of accuracy Since Tsunemitsu and abnormality light are detected by respectively different PD in the case of this optical equipment 210 For example, when dispersion arises in the location of the Z direction of the point P of a laser diode 221 emitting light, it will be moved in the direction of arrow-head B shown in drawing 13 (b) by spot light, and there is inconvenience of becoming easy to produce poor detection of spot light.

[0015] Moreover, although 2 ****s of PDs341 are made right and left among drawing as the mold optical equipment 310 corresponding to the DPD method shown in drawing 14 R> 4 used abundantly at a DVD player etc. is shown in drawing 15 (a) Like the case where it mentions above, when dispersion arises in the location of the Z direction of the point P of a laser diode emitting light, spot light will be moved in the direction of arrow-head B shown in drawing 15 (b), and there is inconvenience of becoming easy to produce poor detection of spot light.

[0016] That is, with the optical equipment 210,310 shown in drawing 12 and drawing 14, in order to change the spot light location of a laser beam into a good condition, it is necessary to perform quite highly precise positioning about the

point P emitting light not only about X and the direction of Y but about a Z direction.

[0017] moreover, when producing the optical equipment 110 mentioned above, for example, at the process which attaches prism 130 in the integrated-circuit substrate 140 Generally, in order to maintain whenever [angle-of-reflection / of each reflector of prism 130] to high degree of accuracy Prism 130 is not attached every integrated-circuit substrate 140, but it has activity composition to which rod-like prism is laid in the wafer with which two or more integrated-circuit substrates 140 were formed, and the dicing also of the prism 130 is made it with the dicing of the integrated-circuit substrate 140.

[0018] However, by the manufacture approach mentioned above, as shown, for example in drawing 10 , it is necessary to bring near the wire BONINGU pad section 144 formed on the integrated-circuit substrate 140 as much as possible, and to form it in a photodiode 120 side, and the working efficiency of a wire BONINGU activity with the leadframe and the wire BONINGU pad section 144 which are not illustrated gets remarkably bad in many cases.

[0019] Furthermore, since the dicing of the integrated-circuit substrate 140 and the prism 130 is simultaneously carried out as mentioned above, when the width of face of the direction of X of the integrated-circuit substrate 140 is expanded, the width of face of prism 130 will also be expanded according to it, the utilization ratio of prism 130 gets worse by this, and it leads to buildup of the manufacturing cost of optical equipment 110 in many cases.

[0020] This invention is made in view of the situation mentioned above, and the object can make accuracy combine the transmitted light with the light-receiving field of a photo detector, and is to offer the optical equipment which can moreover be manufactured cheaply easily, and its manufacture approach.

[0021]

[Means for Solving the Problem] In order to attain the above-mentioned object, the optical equipment of this invention At least one light emitting device by which at least the part was laid on the 1st pedestal which has light transmission nature, and said 1st pedestal, On said 1st pedestal, set said light emitting device and predetermined spacing, and it is laid, branch a part of outgoing radiation light [at least] of the light emitting device concerned, and an irradiated object is irradiated. It has the 2nd pedestal in which the 1st pedestal concerned was attached so that it may have an optical branching means to guide the reflected light from the irradiated object concerned so that said 1st pedestal may be penetrated, and a photo detector and the transmitted light of said 1st pedestal may be combined in the light-receiving field of the photo detector concerned.

[0022] Moreover, the optical branching means of the optical equipment of this invention is a spectroscope, the outgoing radiation light of said light emitting device is branched to said spectroscope, and the optical branching side which guides the reflected light from said irradiated object is formed in it. In addition, when said spectroscope is a birefringence spectroscope, after the reflected light from said irradiated object carries out incidence to said birefringence spectroscope, it separates into the 2 flux of lights of Tsunemitsu and abnormality light inside said birefringence spectroscope, and at least two photo detectors which receive them independently are prepared.

[0023] The 1st pedestal in which the optical equipment of this invention is optical equipment which reads the information which detected the amount of reflected lights of the light which irradiated the optical disk, and was recorded on said disk, and at least a part has light transmission nature, On at least one light emitting device laid on said 1st pedestal, and said 1st pedestal An optical branching means to set said light emitting device and predetermined spacing, to be laid, to branch a part of outgoing radiation light [at least] of the light emitting device concerned, and to irradiate said optical disk, and to guide the reflected light from the optical disk concerned so that said 1st pedestal may be penetrated, It has a photo detector, and it has the 2nd pedestal in which the 1st pedestal concerned was attached so that the transmitted light of said 1st pedestal may be combined in the light-receiving field of the photo detector concerned. Moreover, the optical branching means of the optical equipment of this invention is a spectroscope, the outgoing radiation light of said light emitting device is branched to said spectroscope, and the optical branching side which guides the reflected light from said optical disk is formed in it.

[0024] The manufacture approach of the optical equipment of this invention branches a part of outgoing radiation light [at least] of the light emitting device of at least 1, and said light emitting device, and irradiates an irradiated object. The process which lays an optical branching means to guide the reflected light from the irradiated object concerned so that the 1st pedestal may be penetrated, on the 1st [said] pedestal in which at least a part has light transmission nature, The arrangement condition of the light emitting device laid on said 1st pedestal and an optical branching means is measured. It has the process which computes the transparency location of the transmitted light concerned in said 1st pedestal, and the process which attaches said 1st pedestal on said 2nd pedestal so that it may be combined based on said calculation result in the light-receiving field of a photo detector where the transparency location of said transmitted light was established in the 2nd pedestal.

[0025] Moreover, the manufacture approach of the optical equipment of this invention has suitably the process which considers said each 1st pedestal as an optical block, and carves it into a wafer for every block after laying said light emitting device and an optical branching means on the 1st [said] pedestal by which two or more formation was carried out, respectively. Still more suitably, said optical branching means is laid over two or more optical blocks, and when carving said each optical block, it can be carved simultaneously.

[0026] According to the optical equipment of this invention, a part of outgoing radiation light [at least] from the light emitting device laid on the 1st pedestal branches with the optical branching means similarly laid on the 1st pedestal, and the branched outgoing radiation light is irradiated by the irradiated object. The reflector is formed in the irradiated object and the outgoing radiation light from a light emitting device is reflected by the reflector. Next, the reflected light is guided so that the field which has the light transmission nature prepared in the 1st pedestal with an optical branching means may be penetrated. The transmitted light guided by the optical branching means is combined in the light-receiving field of the photo detector prepared in the 2nd pedestal. When the optical branching means mentioned above is for example, a birefringence spectroscopy, waves are guided inside a birefringence spectroscopy and the reflected light reflected by the reflector of an irradiated object is divided into the 2 flux of lights of Tsunemitsu and abnormality light in the interior. The two separated light penetrates the field which has the light transmission nature eventually prepared in the 1st pedestal, and is combined in at least two light-receiving fields of a photo detector established in the 2nd pedestal. Between them, it is reflected by the inside of a birefringence spectroscopy, or the rate of those light is carried out in part. The light by which the rate was carried out in part is combined with another photo detector which penetrated the 1st pedestal and was prepared in the 2nd pedestal.

[0027] Moreover, according to the optical equipment of this invention, a part of outgoing radiation light [at least] from the light emitting device laid on the 1st pedestal branches with the optical branching means similarly laid on the 1st pedestal, and the branched outgoing radiation light is irradiated by the optical disk. The reflector is formed in the optical disk and the outgoing radiation light from a light emitting device is reflected by the reflector. Next, the reflected light is guided so that the field which has the light transmission nature prepared in the 1st pedestal with an optical branching means may be penetrated. The transmitted light guided by the optical branching means is combined in the light-receiving field of the photo detector prepared in the 2nd pedestal. Consequently,

the quantity of light of the transmitted light is detected and the information recorded on the optical disk is read.

[0028] According to the manufacture approach of the optical equipment of this invention, after passing through the process which lays a light emitting device and an optical branching means on the 1st pedestal, the arrangement condition of the light emitting device and the optical branching means which have been arranged on the 1st pedestal is measured, and the transparency location of the transmitted light in the 1st pedestal is computed. After passing through a calculation process, the 1st pedestal is attached on the 2nd pedestal so that it may be combined based on the calculation result in the light-receiving field of a photo detector where the transparency location of the transmitted light was established in the 2nd pedestal. When two or more 1st pedestals are formed in the wafer, after laying a light emitting device and an optical branching means in each 1st pedestal, respectively, each 1st pedestal can be carved for every block as an optical block. When the optical branching means is laid over two or more optical blocks at this time, that optical branching means can also be carved simultaneously.

[0029]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the optical equipment of this invention is explained based on a drawing. Drawing for the perspective view showing the gestalt of operation of the optical equipment which drawing 1 requires for this invention, and drawing 2 (a) to explain the birefringence prism of the optical equipment shown in drawing 1, and drawing 2 (b) are drawings for explaining the optical block and integrated-circuit substrate of optical equipment which are shown in drawing 1.

[0030] The mold optical equipment (only henceforth [the gestalt of this operation] "optical equipment") 10 corresponding to the optical MAG signal shown in drawing 1 For example, the photodiode 20 which is made to generate the laser beam which irradiates optical disks, such as CD which is not illustrated, and detects the output reinforcement of the laser beam, The optical disk which a part of outgoing radiation light from a laser diode 21 is branched, and is not illustrated is irradiated. The prism 30 which has the birefringence as an optical branching means to guide waves so that the transparence substrate 35 which mentions later the reflected light reflected by the reflector formed in the optical disk may be penetrated, A photodiode 20 is laid in the top face, and it consists of a transparence substrate 35 which can penetrate the reflected light guided by prism 30, and an integrated-circuit substrate 40 with which the circuit which operates a photodiode 20 to a silicon substrate is formed.

[0031] PIN diode (what has a low concentration layer in the pn junction of silicon) 23 as a photo detector for the monitors by which a photodiode 20 receives the outgoing radiation light from the back of the laser diode 21 as a light emitting device and a laser diode 21 is arranged. A laser diode 21 carries out outgoing radiation of the laser beam in the direction parallel to the top face of the transparence substrate 35 to light-receiving side 30a of prism 30.

[0032] As shown in drawing 2 (a), when it sees from [of the system of coordinates set as drawing 1] X, prism 30 has the cross section where two pairs of opposed faces other than light-receiving side 30a are parallel, and divides into Tsunemitsu and abnormality light the reflected light from the optical disk which branched by light-receiving side 30a and which is not illustrated with the birefringence property.

[0033] In the field which does not cover PD42 as a photo detector which was prepared in the integrated-circuit substrate 40 among contact side 30b of light-receiving side 30a, and the prism 30 and the transparence substrate 35, and which is mentioned later The optical branching film (henceforth "BS film") which branches the reflected light from the optical disk by which incidence is carried out to light-receiving side 30a is vapor-deposited, and a part of reflected light from an optical disk penetrates the BS film, it carries out incidence to PD41, and the remaining light is reflected in the prism 30 interior.

[0034] Moreover, the high reflective film (henceforth "HR film") is vapor-deposited by contact side 30b shown in drawing 2 (a), and flat-surface 30c which counters so that light can be received in the light-receiving field of PD42 which mentions later the reflected light by which penetrated light-receiving side 30a and incidence was carried out to the prism 30 interior through the transparence substrate 35. The nonreflective film (henceforth "AR film") is vapor-deposited by 30d of flat surfaces furthermore formed in the tooth-back side of prism 30 so that the output from the front of a laser diode 21 can be detected.

[0035] The transparence substrate 35 is suitably formed for example, with the sapphire glass which has high thermal conductivity and was excellent in heat dissipation nature. A photodiode 20 and prism 30 set predetermined spacing, and are arranged on the top face of the transparence substrate 35 so that drawing 2 (b) may show, and the outgoing radiation light from a laser diode 21 may intersect perpendicularly at the include angle of 45 degrees to light-receiving side 30a.

[0036] The reflected light reflected with the optical disk which is not illustrated penetrates light-receiving side 30a, incidence of the transparence substrate 35 is carried out into prism 30, a part penetrates BS film on contact side 30b, and the

incident light appears in rear-face side 35a of the transparence substrate 35. Moreover, it is smaller than the integrated-circuit substrate 40, and the continuation side with the both-sides side of prism 30 is formed so that drawing 1 may show the transparence substrate 35. Such a continuation side is formed because the dicing also of the prism 30 is simultaneously carried out when carrying out the dicing of the transparence substrate 35.

[0037] The integrated-circuit substrate 40 has PD41 and PD42a which detect the reflected light from the optical disk which is not illustrated, PD42b, and PD43 which carries out the direct monitor of the output from the front end face of laser, as already stated. Moreover, it is divided into the 2 flux of lights of Tsunemitsu and abnormality light after incidence in prism 30, separation becomes large gradually, and the reflected light from an optical disk is detected independently in the location of PD42a and PD42b. In addition, the condition of the most suitable spot light in the detection field of PD41 of this optical equipment 10, PD42a, and PD42b is in the condition shown in drawing 13 (a). Moreover, two or more wirebonding pad sections 44 by which wirebonding is carried out to the lead of the package which is not illustrated are formed in the direction in alignment with a longitudinal direction on the integrated-circuit substrate 40 top face so that drawing 1 may show.

[0038] PD41, PD42a, and PD42b can detect the diameter of a spot of the laser beam by which outgoing radiation was carried out from the laser diode 21, location change of the diameter of a spot, etc., and, thereby, can read the tracking error signal TE, focal error signal FE, and the information signal RF recorded on the optical disk which is not illustrated. In addition, ejection of these signals is performed by the well-known approach, respectively.

[0039] The calculation approach of each signal mentioned above is explained based on drawing 11. The information signal RF recorded on the optical disk which the tracking error signal TE does not illustrate by the degree type (2), and focal error signal FE does not illustrate by the degree type (3) by the degree type (1) is computed using the signal a, b, c, and d acquired from 2 sets of photo detectors 141, 142 shown in drawing 11, i.e., signals, and Signals i, j, k, and l, respectively.

[0040]

$$TE = \{(a+b)-(c+d)\} + \{(k+l)-(i+j)\} \quad -- (1)$$

[0041]

$$FE = \{(a+d)-(b+c)\} - \{(i+l)-(j+k)\} \quad -- (2)$$

[0042]

$$RF = a+b+c+d+i+j+k+l \quad -- (3)$$

[0043] That is, detection of the information signal RF which detection of focal error signal FE by the deflection of vertical movement of an optical disk was performed by detecting the size of spot light, and detection of the tracking error signal TE was performed by the well-known push pull method, and was recorded on the optical disk will be detected by the sum of spots S1 and S2, respectively.

[0044] Next, the optical path of the laser beam by which outgoing radiation was carried out from the laser diode 21 is explained based on drawing 1 and drawing 2. A part of laser beam L by which outgoing radiation was carried out from the point P of the laser diode 21 laid on the transparence substrate 35 emitting light branches by light-receiving side 30a by which BS film of the prism 30 similarly laid on the transparence substrate 35 was vapor-deposited. Light-receiving side 30a is penetrated and waves are guided inside prism 30, and a part of branched outgoing radiation light is diffused, passing only a predetermined include angle through the interior of the prism 30 after the waveguide direction was refracted by light-receiving side 30a.

[0045] A part of laser beam L guided in prism 30 is eventually drawn by the exterior of prism 30 through AR film. Incidence of a part of drawn laser beam L is carried out to PD43 for laser output monitors, it is fed back to an external laser driver circuit, and is used for control of a laser output.

[0046] It is reflected in the method of drawing Nakagami by light-receiving side 30a, it is condensed by one point through the objective lens which is not illustrated, and a part of branched remaining outgoing radiation light is irradiated by the reflector of the optical disk which is not illustrated. If the pit exists in the reflector at this time, phase contrast will arise between the laser beam reflected through that pit, and the laser beam at the time of the exposure to an optical disk, and the quantity of light of the reflected light will decrease. It becomes possible by detecting the difference of this quantity of light using PD41, PD42a, and PD42b to read the information recorded on the optical disk. Moreover, tracking control and focal control are performed by the operation of those detecting signals.

[0047] The reflected light from the reflector of an optical disk returns to light-receiving side 30a again, and incidence is carried out to the prism 30 interior. This incident light is separated into the 2 flux of lights of Tsunemitsu and abnormality light by prism 30, and that quantity of light is detected by PD42a and PD42b, respectively. An optical MAG signal is acquired based on this detection result. For example, if prism 30 is produced so that Tsunemitsu and abnormality luminous intensity may become equal exactly in the condition that there is no revolution of polarization, suitably, an optical MAG signal will be acquired by

formula (detection result of PD42a) - (detection result of PD42b). The laser beam from a laser diode 21 will be combined with the light-receiving field of each PD through the optical path described above, respectively.

[0048] Next, the manufacture approach of this optical equipment 1 is explained based on drawing 1 R> 1 - drawing 5. Drawing for explaining signs that the flow chart which shows the manufacture approach of optical equipment which shows drawing 3 in drawing 1, and drawing 4 attach the photodiode and prism which are used for the optical equipment shown in drawing 1 on a transparence substrate, and drawing 5 are drawings for explaining signs that the transparence substrate with which a photodiode and prism were attached is attached in an integrated-circuit substrate.

[0049] First, as shown in drawing 3 and drawing 4, a photodiode 20 and prism 30 are fixed to the transparence substrate 35 by which two or more formation was carried out using adhesives, such as installation, a silver paste, and UV resin, respectively in a wafer. The prism 30 attached at this time is carrying out the shape of a bottom rod extended in the direction of light-receiving side 30a, and is arranged over two or more transparence substrates 35 (ST1). In addition, it is for maintaining the include angle of light-receiving side 30a [as opposed to a photodiode 20 for light-receiving side 30a] to homogeneity and high degree of accuracy as a reason for using such prism 30, and the inconvenience that light-receiving side 30a varies every transparence substrate 35 by this is canceled.

[0050] After a photodiode 20 and prism 30 are attached, in accordance with the parting line formed on the transparence substrate wafer, the dicing of each transparence substrate 35 with which a photodiode 20 and prism 30 were laid is carried out for every optical block as one optical block. At this time, the dicing also of the prism 30 of the shape of a bottom rod mentioned above to the dicing and coincidence of the transparence substrate 35 is carried out (ST2).

[0051] Two or more parameters, such as thickness of the physical relationship of a photodiode 20 and prism 30, the coordinate (X, Y, Z) of the point P emitting light, prism height, the mounting gate include angle theta, and the transparence substrate 35, are measured by each transparence substrate 35 in the condition that a photodiode 20 and prism 30 have been arranged, after dicing completion of the transparence substrate 35 and prism 30. When a laser beam emits light from the point P emitting light, each spot light location expressed on the underside of the transparence substrate 35 is computed by the optical-path count based on this measurement result (ST3).

[0052] After each spot light location is computed, the transparence substrate 35 with which a photodiode 20 and prism 30 were attached is fixed to the shape of a

semi-conductor wafer with adhesives, such as installation and UV resin, at the integrated-circuit substrate 40 by which two or more formation was carried out so that each of that spot light location may be held in each light-receiving field which PD41 and PD42a which are shown in drawing 5, and PD42b do not illustrate (ST4). If the dicing of the semi-conductor wafer is finally carried out every integrated-circuit substrate 40 (ST5), optical equipment 10 will be produced.

[0053] With the gestalt of this operation, although for example, sapphire glass was used as a transparence substrate 35, it may change to this and a glass substrate, a diamond substrate, etc. may be used. In addition, anything may be used for the transparence substrate 35 as long as it is the construction material which is made to transmit to each photo detector, without making the incident light which carried out incidence into prism dim, or making it spread. Moreover, although a laser diode 21 can carry out direct modulation of the amount of the light to emit and has the merit that the bleedoff quantity of light per unit volume is large, since the calorific value at the time of luminescence is comparatively large, in this point, the good ingredient of heat dissipation nature with high heat-conduction effectiveness is more convenient.

[0054] With the gestalt of this operation, although BS film is prepared in a part of contact side 30b of prism 30 and the transparence substrate 35, BS film is not limited to the field. For example, you may prepare in the near field of the photo detector 41 by the side of the rear face of the transparence substrate 35 among the contact sides of the transparence substrate 35 and the integrated-circuit substrate 40.

[0055] With the gestalt of this operation, although the optical equipment 10 of the mold corresponding to an optical MAG signal was explained, as shown in drawing 6, the photo detector 41 which receives directly the reflected light from the optical disk which is not illustrated is divided, and it can completely respond to the mold optical equipment corresponding to the DPD method this performs phase contrast detection (DPD) of the reflected light, similarly. Moreover, the optical block attached on one integrated-circuit substrate 40 is not limited to one. That is, as shown in drawing 7, two or more optical blocks may be laid on one integrated-circuit substrate 40. Furthermore, it is good also as a configuration which is communalized to one sheet and attaches the transparence substrate 35 of two or more optical blocks on one integrated-circuit substrate 40. In such a case, as shown in drawing 7, the class of a photodiode 20 or prism 30 may use a thing different, respectively.

[0056] since the optical block which laid a photodiode 20 and a prism 30 on the transparence substrate 35 be established according to the optical equipment 10

of the gestalt of this operation as explained above, measurement of the various parameters which include the point emit light etc. in the state of an optical block can be performed easily, and can compute each spot light location of the transmitted light which penetrates the transparency substrate 35 from the measurement result. Therefore, it becomes possible to attach the transparency substrate 35 in the integrated-circuit substrate 40, and positioning of high degree of accuracy is attained so that it may be made to join together in the light-receiving field of PD41 and PD42a in which each of that computed spot light location was established by the integrated-circuit substrate 40, and PD42b.

[0057] Moreover, according to the optical equipment 10 of the gestalt of this operation, prism 30 can carve simultaneously at the time of the dicing of the transparency substrate 35, therefore not only the effectiveness that the include angle of light-receiving side 30a to a photodiode 20 is maintainable to homogeneity and high degree of accuracy but the prism 30 can use it efficiently, and a manufacturing cost is held down cheaply. Furthermore, since the location of the wirebonding pad section 44 can arrange near the center section of the integrated-circuit substrate 40 as shown in drawing 1, a wirebonding activity becomes easy and the working efficiency of an assembly activity improves.

[0058] Moreover, according to the optical equipment 10 of the gestalt of this operation, since it is not necessary to constitute a circuit in the transparency substrate 35, the transparency substrate 35 can be set up small as much as possible, and compact optical equipment 10 can be realized.

[0059] Moreover, since according to the optical equipment of the gestalt of this operation preparing-in each flat surface of prism 30 film setting out can set up independently for every optical block when laying two or more optical blocks on one integrated-circuit substrate 40, the prism 30 optimal as optical system can be constituted.

[0060] Since the transparency substrate 35 was furthermore constituted from a sapphire substrate according to the optical equipment of the gestalt of this operation, heat-conduction effectiveness is high and the high optical equipment 10 of heat dissipation nature can be realized.

[0061]

[Effect of the Invention] According to the optical equipment of this invention, there is an advantage that the transmitted light which penetrates the 1st pedestal to the light-receiving field of a photo detector can be combined with accuracy.

Moreover, according to the manufacture approach, the optical equipment which has the advantage mentioned above can be manufactured cheaply easily to the optical equipment of this invention.

[Translation done.]

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